UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF WASHINGTON
AT SEATTLE

RAMGEN POWER SYSTEMS LLC, Plaintiff, v. AGILIS ENGINEERING INC, Defendant.	CASE NO. C12-1762 MJP FINDINGS OF FACT AND CONCLUSIONS OF LAW

This matter was tried to Court without a jury beginning on September 15, 2014 and ending on October 2, 2014, before the Honorable Marsha J. Pechman, United States District Court Judge. Plaintiff Ramgen Power Systems, LLC ("Ramgen") was represented by Michael A. Goldfarb, Christopher M. Huck, and Kit W. Roth of Kelley, Goldfarb, Huck & Roth, PLLC. Defendant Agilis Engineering, Inc. ("Agilis") was represented by Dean Rosenbach and Marshall Rosenbach of The Law Offices of Marshall E. Rosenbach, and Peter Steilberg, III of Merrick, Hofstedt & Lindsey, PS.

I. FINDINGS OF FACT

Based on the evidence presented at trial, the Court makes the following findings of fact:

Jurisdictional Background

1. The Court has subject matter jurisdiction pursuant to 28 U.S.C. § 1332(a) because there is complete diversity of citizenship between Plaintiff and Defendant and because the amount in controversy exceeds $75,000.

2. Agilis contracted with Ramgen to design and manufacture a supersonic, shockwave-based, low-pressure CO2 compressor rig (the "Rig") for delivery to Redmond, Washington.

3. In the contract executed by Ramgen and Agilis on February 25, 2011, the parties agreed that "the state and federal courts within the State of Washington, USA will have exclusive jurisdiction to adjudicate any dispute arising out of this agreement," and the parties agreed to "hereby submit to the jurisdiction and venue in such courts and service of process by any means permitted thereby." See Trial Exhibit 253-0005 at ¶ 11.4.

The Parties

4. Ramgen is a privately-held company focused on energy-related applications of supersonic aircraft technology.

5. Ramgen received funding from the United States Department of Energy ("DOE") and other private investors, including Dresser-Rand, to develop a supersonic shockwave-based high-pressure CO_2 compressor and gas turbine engine power generation system.

6. To obtain test data for Ramgen to use in the DOE project, Ramgen approached Agilis to design, manufacture, deliver, and install what the industry refers to as a "Rig." A Rig is designed not to be a product but a tool to gather data to test research hypotheses. The Rig's sole purpose was to supply Ramgen with test data for the DOE project.

7. Agilis is a Florida corporation that transacts business nationwide.

8. In answering requests for admission, Agilis admitted to making the following representations to Ramgen: (a) it is "a leader in engineering design, development and analysis of turbine engines;" (b) it has "developed into a leader in creating advanced, efficient turbine

engines;" (c) its "Quality Policy Statement" is as follows: "to provide high quality, on time services to satisfy customer needs and expectations using the ISO 9001:2008 certified Quality Management System, including quality objectives;" (d) it is "uniquely positioned to perform this program with extensive design/structures modeling and analytical experience in various operational rigs and mechanical system designs;" (e) it has "demonstrated capability to procure, assemble, instrument, manage and test complex component rigs up to and including full engine testing;" and (g) it has "extensive experience with rig and engine programs for both aviation and industrial applications." (Dkt. No. 118 at 5-6.)

Agreement and Amendments

9. Agilis submitted to Ramgen a proposal under which Agilis would design, manufacture, deliver, and install the Rig for $1,756,000.00, including the Preliminary Design, Detail Design, Hardware Procurement, Instrumentation, Assembly, and Installation Support. In this February 9, 2011 proposal, Agilis also proposed a Rig ship date of August 1, 2011. See Trial Exhibit 293.

10. In its proposal to Ramgen, Agilis represented that: (a) "Agilis will assign a dedicated team which will execute the design, analyses, hardware procurement, instrumentation, and assembly of the CO2 compressor Rig Program;" (b) "Ramgen will benefit from the efficiencies of a dedicated integrated product team, focused on attention to detail, first time quality, effective communication, and efficiency;" and (c) "Agilis will perform design, modeling and structural analysis work to Agilis design standards and best practices." See Trial Exhibits 293-0002 and 293-0005.

11. Testimony from Frank O'Neill, Michael Ladd, and Joseph Joyce confirmed that Agilis standards are synonymous with best industry practices.

12. On or about February 25, 2011, Ramgen executed a contract with Agilis for the Rig. In the contract, Agilis represented, warranted, and contractually agreed that its work and deliverables to Ramgen "will be performed, prepared and delivered in conformity with (i) the highest standards of quality and professionalism in the engineering and design industry." See

Trial Exhibit 253-0001 at ¶ 1.1. In addition, the February 25, 2011 contract expressly incorporated Agilis's February 9, 2011 proposal, which includes the representations that Agilis made in its proposal. See Trial Exhibit 253-0008.

13. Agilis also warranted and contractually agreed that it: (a) "will defend, indemnify and hold Ramgen and its employees harmless from, and against all losses, claims, damages, and expenses including reasonable attorney's fees arising out of Contractor's performance, negligent acts or omissions, or from any third party legal actions, lawsuits, or claims arising out of Contractor's work and performance of services under this Agreement;" (b) "will defend, indemnify and hold Ramgen and its customers harmless from and against all losses claims, liabilities, damages and expenses (including reasonable attorneys' fees) . . . arising from any breach of Contractor's warranties, covenants or obligations . . . or otherwise arising out of or in connection with Contractor's acts or omissions;" and (c) in the event of a dispute, the prevailing party is entitled to attorney's fees. See Trial Exhibits 253-0003 and 253-0005.

14. Agilis's representations, warranties, contractual obligations regarding the quality of its work and deliverables were reaffirmed and carried forward through each of the amendments to the contract on April 11, 2011 and again on April 19, 2011.

15. On May 19, 2011, Agilis presented its design of the Rig at a Detailed Design Review, also referred to by Agilis as the final design review. A week later, Agilis submitted a new proposal increasing the projected cost of the Rig to $3,136,900.00 and pushing off the expected delivery of the Rig to October 19, 2011, rather than August 1, 2011.

16. In that proposal, Agilis expressly represented, warranted, and contractually agreed that "[a]ssembly of the rig with the dummy diffuser will be done on-site at Agilis. Agilis will provide all instrumentation identified in the Detailed Design Review. All instrumentation will be checked for functionality after installation on hardware, prior to rig shipment, and at final rig installation at Ramgen." See Trial Exhibit 812-0002. Agilis also expressly represented, warranted, and contractually agreed that "Agilis will perform design, modeling and structural analysis work to Agilis design standards and best practices." See Trial Exhibit 812-0004. Agilis

reiterated and contractually agreed to these representations in a June 1, 2011 Amendment to the contract and a November 10, 2011 Amendment to the contract.

17. In the June 1, 2011 Amendment, Agilis also agreed that "[a]ssembly of the rig with the dummy diffuser will be done on-site at Agilis. Agilis will provide all instrumentation identified in the Detailed Design Review. All instrumentation will be checked for functionality after installation on hardware, prior to rig shipment, and at final rig installation at Ramgen." See Trial Exhibit 254-0001. Agilis also agreed in the Amendment that "Agilis would provide personnel to install the rig and connect the rig to the installed piping system." See Trial Exhibit 254-0002. Agilis also again contractually agreed that "Agilis will perform design, modeling and structural analysis work to Agilis design standards and best practices." Id.

18. In the November 10, 2011 Amendment, Agilis agreed that "[a]ssembly of the rig with the dummy diffuser will be done on-site at Agilis. Agilis will provide all instrumentation identified in the Detailed Design Review. All instrumentation will be checked for functionality after installation on hardware, prior to rig shipment, and at final rig installation at Ramgen." See Trial Exhibit 255-0001. Agilis also agreed that it would "use its Supplier resources if needed to correct fit/functional conflicts during assembly and quality inspections." Id. Agilis agreed that it would "ship assembled rig installed on the skid on a fully enclosed air ride trailer." See Trial Exhibit 255-0002. And Agilis agreed that it would "perform instrumentation and assembly to Agilis standards and best practices." Id.

19. The November 10, 2011 Amendment increased the contract with Agilis to a Firm Fixed Price of $4,051,300.00, which Ramgen paid in full to Agilis, and included a best effort target of January 16, 2012 for delivery of the assembled and instrumented Rig to Ramgen in Redmond. See Trial Exhibit 255.

20. Ultimately, Ramgen ended up paying Agilis $4,087,646.00 million for the Rig. Ramgen coded each of its expenditures and time kept in an accounting, separating out this project from other ongoing work being carried out by Ramgen. This was required by and approved by the DOE as part of the terms for receipt of the grant from the DOE. Ramgen also

incurred $1,886.208.00 of internal costs with respect to the Rig. See Trial Exhibit 181. Those internal costs were incurred in reliance on the agreement made with Agilis and the expenditure of $1,886.208.00 was made by Ramgen in preparation for and in performance of the agreement with Agilis. In addition, Ramgen made payments directly to third party contractors with respect to the Rig, which amounts total $927,267.00. See Trial Exhibit 113. Those third party costs were also were incurred in reliance on the agreement made with Agilis and the expenditure of $927,267.00 was made by Ramgen in preparation for and in performance of the agreement with Agilis. Ramgen's total damages are $6,901,121.

Misdesign and Fundamental Defect

21. At the May 19, 2011 Detailed Design Review, Agilis presented to Ramgen Agilis's proposed design of the Rig. That presentation included Agilis's Campbell diagram depicting Agilis's modal analysis of the resonance characteristics of the Rig's nosecone's design. Under standard engineering practice, a fundamental step in designing rotating machinery is to ensure that the machinery's rotating parts and adjacent non-rotating parts (such as the Rig's nosecone) will not resonate at the machinery's intended operating speed.

22. Agilis made fundamental errors in its modal analysis of the Rig's nosecone and in the Campbell diagram that it presented to Ramgen at the May 19, 2011 Detailed Design Review, rendering the modal analysis and Campbell diagram useless as a tool to predict future problems with resonance. The Campbell diagram was fundamentally flawed and fell below standard practices in the engineering industry, contrary to Agilis's representations to Ramgen.

23. After the Detailed Design Review, Agilis made significant changes to the design of the nosecone but did not perform a new modal analysis and plot a new Campbell diagram on the redesigned nosecone or perform vibration testing (also known as ping testing) on the manufactured nosecone, even though doing so after design changes is standard industry practice. Instead, Agilis relied on the erroneous modal analysis and Campbell diagram from the Detailed Design Review. This was a fundamental engineering design mistake, below standard practices in the engineering industry.

24. As a result, the nosecone was designed such that it would resonate at the Rig's intended operating speed. Because of this fundamental defect, the Rig was destined to fail if operated at the speeds it was to achieve to collect useful data.

25. The severity of Agilis's deficient design was exacerbated because there was no practical way to accurately align the rotor and nosecone and measure the axial and radial gaps after assembly. In addition, the design changes that Agilis made to the nosecone and rotor after the Detailed Design Review rendered the Rig even more susceptible to contact between the nosecone and rotor in the event of a nosecone resonance. As a result of Agilis's redesign, the aft edge of the nosecone was bordered by the rotor on three sides. Movement of the nosecone in any one of three directions could result in contact between the stationary nosecone and the spinning rotor.

26. Agilis acknowledged these defects in a document which listed the "Assembly Issues" and "Lessons Learned" by Agilis in building the Rig. In the document, Agilis described the actions taken by Agilis as follows: "Nose cone attachment could have had a removable nose to provide visual inspection of the interface between the knife edges and honeycomb" — "Assembled blind no visual inspection made, rotated rotor and listened for rub." See Trial Exhibit 325-0004. The document also described that there were "[n]o provisions to remove bearings safely." See Trial Exhibit 325-0003.

27. One of Agilis's employees who assembled the Rig noted in an email to the Rig project manager:

> As currently designed/built there are various contributors that effect alignment and minor changes to the alignment are enough to cause misalignment and binding . . . Operating vibrations of the system could easily cause the shims to move and since the clearances within the system are so close minor movement of the shims could cause misalignment and binding of the system.

See Trial Exhibit 370.

Delivery and Operation

28. Agilis delivered the Rig to Ramgen's Redmond facility on January 23, 2012. Ramgen worked on preparations for beginning operation of the Rig. Ramgen was in regular contact with Agilis personnel throughout this process.

29. During the week of March 5, 2012, Agilis employee Edward Brooks was on-site at Ramgen's Redmond facility to support installation of the Rig. Mr. Brooks shimmed various Rig supports and other load-bearing locations on the Rig, to align the Rig and its rotating parts, such as the nosecone and rotor. Mr. Brooks also helped hook up the instrumentation and sensors that would monitor the Rig during operation, which had been installed on the Rig and calibrated by Agilis before delivery to Ramgen.

30. To ensure that the bearings were properly broken in, in early February 2012 Ramgen contacted Agilis and then the manufacturer of the bearings, Barden Corporation, for input regarding the bearing run-in procedure, before initial operation of the Rig. Since the Rig's design precluded Ramgen from using the bearings manufacturer's standard bearing run-in procedure, Ramgen worked out an alternative bearing run-in procedure with the bearings manufacturer. Both Agilis and the bearings manufacturer indicated that 250 to 300 degrees is the running temperature limit for the bearings. Ramgen followed the alternative bearing run-in procedure approved by the bearings manufacturer, and stayed well under the bearings' running temperature limits, and checked to make sure the instrumentation and sensors were working. There is no evidence that Ramgen exceeded a bearing temperature of 225 degrees.

31. Ramgen began operating the Rig in April 2012. Ramgen requested additional support from Agilis during initial operation and break-in of the Rig, including the Rig's bearings. As a result, Agilis sent its employee Christopher Hill to Ramgen's Redmond facility during the week of April 16, 2012. Mr. Hill was on-sight at Ramgen's Redmond facility and participated in each instance the Rig was operated during that week. Mr. Hill worked closely with Ramgen's engineers, including during each instance the Rig was operated. The test team and Mr. Hill discussed the readings from the Rig's instrumentation and sensors during and after each test run.

Mr. Hill did not express any concern over Ramgen's test procedures or how the Rig was operated. In fact, during that week Mr. Hill sent an email to Agilis reporting that operation of the Rig was going well. In his email, Mr. Hill states: "We got to 100% speed today wit [sic] no major issues. Aall [sic] is progressing very well. Instrumentation seems to be working fine. The slow progress is part of the normal bearing run in plan. Everyone is happy." See Trial Exhibit 211.

32. The design intent and purpose of the Rig was to operate on 100% CO_2. The Rig failed before Ramgen was able to operate the Rig on 100% CO_2. On May 10, the Rig was operated at 95% CO_2, the highest concentration of any test to that date. The Rig's motor and rotor had to work harder to move CO_2, which is heavier than air, through the Rig, and the Rig experienced more significant vibrations. Since Agilis had misdesigned the Rig's nosecone, the vibrations caused the nosecone to resonate and come into contact with the spinning rotor at approximately 21,100 repetitions per minute — approximately the Rig's intended operating speed — resulting in a rub event between the Rig's stationary nosecone and spinning rotor, which immediately damaged the Rig and ultimately rendered the Rig inoperable. Given the significant speed at which the rub event occurred, the rotor and nosecone were immediately damaged the moment they came into contact with each other.

33. Ramgen's expert Dr. I-Yeu (Steve) Shen — a tenured professor in the University of Washington's Mechanical Engineering department — investigated the cause of the rub event. Based on, among other things, his review of the data obtained from the Rig's sensors before, during, and after the rub event, his inspection of the Rig and its components, his review of the Rig's design and configuration, and his analysis of the vibration and resonance characteristics of the Rig's nosecone, Dr. Shen concluded that the rub event and failure of the Rig were caused by a resonance of the Rig's nosecone.

34. Dr. Shen based his conclusion on data obtained from the Rig's accelerometers and proximity probes, which measured the Rig's vibration and the position of the Rig's rotor and shaft at the time of the rub event. Agilis's retained expert, Dr. Frank Owen, conceded that the

"the vibration and location data provided by accelerometers and proximity probes are perhaps the most telling indicators of what went wrong in an interference failure." However, Dr. Owen did not review that data in reaching his conclusions presented at trial.

35. In reaching his conclusion that the rub event was caused by a resonance of the Rig's nosecone, Dr. Shen also ruled out the possibility that the Rig's bearings failed and that the Rig's rotor and shaft moved axially. Dr. Shen based his conclusion on data from the Rig's proximity probes which showed no axial movement. Inspection of the Rig also showed that the rotor and shaft had not moved axially. Dr. Shen also concluded that the Rig's accelerometer data showed no signs of increasing bearing vibrations, which would have been present if the bearings had failed. When the shaft was turned by hand, Dr. Shen found that the shaft spins freely, exhibiting no noise, roughness, or other symptoms. Likewise, Ramgen personnel Kirk Lupkes and Paul Brown turned the shaft by hand and found that it turned smoothly, with no symptoms of bearing damage.

36. In contrast, none of Agilis's witnesses physically inspected the Rig after the failure or reviewed the data from the Rig's proximity probes in reaching their conclusions. After the rub event, one of Agilis's witnesses wrote in an email to the Rig project manager that he observed that the rotor and shaft had not moved axially: "The grooves in the honeycomb of the air seal were as expected. Two sets of grooves in the front and two sets in the back. No evidence of axial travel in the rotor. Paul Brown used a spare blade to demonstrate that the knife edges of the rotor fit in the grooves with no axial movement of the blade." See Trial Exhibit 92.

37. Dr. Shen also analyzed Agilis's work in designing and manufacturing the Rig and analyzing the vibration characteristics of the Rig's nosecone. He concluded that Agilis failed to follow basic engineering practices, which resulted in a fundamental error in the design of the Rig's nosecone that caused the ultimate rub event and failure of the Rig. Because of the failures in Agilis's work, the Rig was defective and essentially destined to fail, rendering the Rig unfit for the purposes that Ramgen intended the Rig to serve.

38. Agilis's work fell below best practices in the mechanical engineering industry, as

well as falling below the degree of care, skill, and learning expected of a reasonably prudent engineer in the state of Washington acting in the same or similar circumstances.

39. Testimony from Ramgen personnel Kirk Lupkes and Paul Brown supported the same conclusions about the deficiencies in Agilis's work and the cause of the Rig's failure as those expressed by Dr. Shen.

40. The Rig could not be used unless it was redesigned to correct existing design defects, remanufactured, reinstalled, recalibrated and retested, a process that would have taken at least many months, beyond the time frame which the Rig was useful for Ramgen for the reasons that it was purchased.

41. Due to the rub event, Ramgen did not receive any useful data from the Rig. Given the schedule demands of the DOE project, there was insufficient time to fix the Rig's defects and repair the Rig in time for it to serve its purpose and provide useful data for the DOE project, especially since correcting the problems with the nosecone's design would have required a complete redesign of the nosecone.

42. There is no evidence supporting Agilis's affirmative defense of failure to mitigate damages.

II. CONCLUSIONS OF LAW

1. To the extent that any of the foregoing Findings of Fact are deemed to be conclusions of law, they are incorporated into these Conclusions of Law.

2. This Court has jurisdiction under 28 U.S.C. § 1332. Venue is proper under 28 U.S.C. § 1391.

3. Ramgen's burden of proof on its claims is a preponderance of the evidence.

4. Breach of Contract: There is a valid and enforceable contract between Ramgen and Agilis. Agilis breached its contract with Ramgen by failing to design and build the Rig in accordance with the standards set forth in the contract. Ramgen was damaged by Agilis's breach when the Rig began to resonate causing the nosecone to come in contact with the rotating blades. Proper analysis would have allowed the parties to avoid this failure in the Rig. Accordingly,

Ramgen is entitled "to damages based on [its] reliance interest, including expenditures made in preparation for performance or in performance." Family Medical Bldg., Inc. v. State, Dept. of Social & Health Services, 37 Wn. App. 662, 673, 684 P.2d 77 (1984), aff'd, 104 Wn.2d 105 (1985) (quoting Restatement (Second) of Contracts § 349 (1981)) (emphasis added); see also Floor Exp., Inc. v. Daly, 138 Wn. App. 750, 754, 158 P.3d 619 (2007) ("A party injured by a breach of contract may recover all damages that accrue naturally from the breach, including any incidental or consequential losses the breach caused.").

5. Ramgen has also proved its claim against Agilis for breach of express warranties. Agilis breached its express warranties by failing to design and build the Rig in accordance with the standards set forth in the contract. Ramgen was damaged by Agilis's breach. Accordingly, Agilis is liable for all losses caused by its breach of a warranty, including all costs incurred by Ramgen in connection with the failed Rig. See Crandall Eng'g Co. v. Winslow Marine Ry. & Shipbuilding Co., 188 Wash. 1, 16, 61 P.2d 136 (1936) ("The remedies are alike for all breaches of warranty, even those including what was formerly known in our state and at common law."); see also MacCormack v. Robins Const., 11 Wn. App. 80, 83, 521 P.2d 761 (1974) (affirming judgment against homebuilder for common law breach of warranty); ExxonMobil Oil Corp. v. Amex Const. Co., Inc., 702 F. Supp. 2d 942, 964 (N.D. Ill. 2010) (pipe installer was liable for all damages proximately caused by breach of warranty); Gibraltar Sav., F.A. v. First Mortgage Corp., 825 F. Supp. 750, 751 (M.D. La. 1993) (damages for breach of warranty in services agreement evaluated under state contract law).

6. No independent duty exists outside of the contract creating tort liability for Agilis. When engineers design for the public or when their designs cause damage downstream, they may have duties outside of the contract that create tort liability. Here the contract was for a tool, although a very large one, to be used for a unique purpose in an experimental lab. The parties could and did contract for the foreseeable risk that the Rig would not function as planned.

7. In addition, Washington's version of the UCC does not apply because this case involves a contract for the sale of services and expertise and not the sale of a good. Ownership

of the Rig never transferred from Agilis to Ramgen. The ownership remained with Ramgen at all times.

8. Ramgen paid Agilis $4,087,646.00 million for the Rig. In reliance on its contract with Agilis, Ramgen also incurred $1,886,208.00 of internal costs and made payments directly to third party contractors of an additional $927,267.00. Accordingly, Ramgen is entitled to an award of damages against Agilis in the amount of $6,901,121.

9. Ramgen is also entitled to an award of pre- and post-judgment interest. In diversity jurisdiction, state law governs all awards of pre-judgment interest. See Mutuelles Unies v. Kroll & Linstrom, 957 F.2d 707, 714 (9th Cir. 1992). A liquidated claim is one where the evidence furnishes data which, if believed, makes it possible to compute the amount with exactness, without reliance on opinion or discretion. See Dautel v. Heritage Home Ctr., Inc., 89 Wash. App. 148, 153-54, 948 P.2d 397, 400 (1997). Plaintiff's damage claims meet this standard, and Plaintiff should be awarded prejudgment interest in the amount of $2,268.86 per day, which is $1,640,387.00 calculated from the filing of the complaint through the last day of trial, plus an additional $2,268.86 per day for each additional day from October 2, 2014 to the date of entry of Judgment in this matter. Post-judgment interest shall accrue as required by law until the Judgment is paid in full.

10. Ramgen is the prevailing party at trial. Thus, Ramgen is also entitled to an award of costs and attorneys' fees to be determined by later motion.

11. Ramgen is directed to prepare a judgment commensurate with these findings and submit it to the Court for signature within seven days of the filing of these findings.

The clerk is ordered to provide copies of this order to all counsel.

Dated this 24th day of October, 2014.

Marsha J. Pechman
United States District Judge